

LISTING OF CLAIMS:

Claims 1-21 (cancelled).

Claim 22 (original): A solid polymer fuel cell system comprising a solid polymer fuel cell and an apparatus for humidifying a reactant gas supply stream, said fuel cell having a reactant gas inlet port and a reactant gas exhaust port, said humidifying apparatus comprising a membrane exchange humidifier comprising:

- (a) a supply stream chamber having an inlet and an outlet, said supply stream chamber inlet having a reactant gas supply fluidly connected thereto, said supply stream chamber outlet being fluidly connected to said fuel cell reactant gas inlet port;
- (b) an exhaust stream chamber having an inlet and an outlet, said exhaust stream chamber inlet fluidly connected to said fuel cell reactant gas exhaust port; and
- (c) a water permeable membrane separating said supply stream chamber and said exhaust stream chamber, whereby water is capable of being transferred across said water permeable membrane from a reactant gas exhaust stream to said reactant gas supply stream, said membrane comprising a microporous polymer and a hydrophilic additive, said membrane when dry being substantially permeable to at least one component of at least one of said reactant gas supply and exhaust streams.

Claim 23 (original): The solid polymer fuel cell system of claim 22 wherein said membrane when wet is substantially impermeable to said at least one component.

Claim 24 (original): The solid polymer fuel cell system of claim 22 wherein said membrane is permeable to up to about 1% of a reactant gas volume during steady state fuel cell operation.

Claim 25 (original): The solid polymer fuel cell system of claim 22 wherein said reactant gas supply stream is an oxidant supply stream and said reactant gas exhaust stream is an oxidant exhaust stream.

Claim 26 (original): The solid polymer fuel cell system of claim 22 wherein said membrane exchange humidifier has a configuration selected from the group consisting of plate-and-frame, spiral wound and tube bundle.

Claim 27 (original): The solid polymer fuel cell system of claim 26 wherein said membrane exchange humidifier has a plate-and-frame stack configuration.

Claim 28 (original): The solid polymer fuel cell system of claim 27 wherein said membrane exchange humidifier configuration comprises a stack of at least one membrane and frame unit, said unit comprising said membrane interposed between an upper frame and a lower frame, said upper frame comprising two upper ports and said lower frame comprising two lower ports, said unit further comprising seals disposed between said membrane and portions of said frame surrounding each of said upper and lower ports, at least one of said seals consisting essentially of a bond formed between said membrane and said upper and lower frames, said membrane comprising four openings, two of said openings aligned with said upper frame ports and the other two of said openings aligned

with said lower frame ports, whereby fluid communication is provided between said lower frame ports and said upper frame interior and between said upper frame ports and said lower frame interior.

Claim 29 (original): The solid polymer fuel cell system of claim 28 wherein said upper ports are located at opposite ends of the upper frame periphery and said lower ports are located at opposite ends of the lower frame periphery.

Claim 30 (original): The solid polymer fuel cell system of claim 28 wherein said seals consist essentially of bonds formed between said membrane and said upper and lower frames.

Claim 31 (original): The solid polymer fuel cell system of claim 28 wherein said two lower frame ports substantially align with said two upper frame ports.

Claim 32 (original): The solid polymer fuel cell system of claim 28 wherein said unit is substantially rectangular.

Claim 33 (original): The solid polymer fuel cell system of claim 28 wherein said lower frame is of substantially the same construction as said upper frame and said upper frame is rotated with respect to said lower frame in said unit.

Claim 34 (original): The solid polymer fuel cell system of claim 22 wherein said membrane comprises formed ribs.

Claim 35 (original): The solid polymer fuel cell system of claim 34 wherein said water permeable membrane is spirally wound and said formed ribs are configured so as to form said supply stream and exhaust stream chambers in said spirally wound membrane.

Claim 36 (original): The solid polymer fuel cell system of claim 34 wherein said formed ribs exhibit a tongue-in-groove geometry.

Claim 37 (original): The solid polymer fuel cell system of claim 22 wherein said membrane comprises a bundle of substantially rectangular tubes.

Claim 38 (original): A solid polymer fuel cell system comprising a solid polymer fuel cell and an apparatus for humidifying a reactant gas supply stream, said fuel cell having a reactant gas inlet port and a reactant gas exhaust port, said humidifying apparatus comprising:

- (a) a membrane exchange humidifier comprising a supply stream chamber having an inlet and an outlet, said supply stream chamber inlet having a reactant gas supply fluidly connected thereto, said supply stream chamber outlet being fluidly connected to said fuel cell reactant gas inlet port, said membrane exchange humidifier comprising a stack of at least one membrane and frame unit, said unit comprising said membrane interposed between an upper frame and a lower frame, said upper frame comprising two upper ports, said lower frame comprising two lower ports, said membrane comprising four openings, two of said openings being aligned with said upper frame ports and the other two of said openings being aligned with said

lower frame ports, said unit comprising seals disposed between said membrane and the frame portions surrounding each of said upper and lower ports, at least one of said seals consists essentially of a bond formed between said membrane and said upper and lower frames, whereby fluid communication is provided between said lower frame ports and said upper frame interior and between said upper frame ports and said lower frame interior;

- (b) an exhaust stream chamber having an inlet and an outlet, said exhaust stream chamber inlet fluidly connected to said fuel cell reactant gas exhaust port; and
- (c) a water permeable membrane separating said supply stream chamber and said exhaust stream chamber;

whereby water is capable of being transferred across said water permeable membrane from a reactant gas exhaust stream to said reactant gas supply stream.